

(19) World Intellectual Property
Organization
International Bureau



Rec'd PCT/ 23 FEB 2005



(43) International Publication Date
4 March 2004 (04.03.2004)

PCT

(10) International Publication Number
WO 2004/017750 A1

- (51) International Patent Classification⁷: **A23K 1/14**
- (21) International Application Number: **PCT/AU2003/001071**
- (22) International Filing Date: **22 August 2003 (22.08.2003)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data: **2002951128 23 August 2002 (23.08.2002) AU**
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- (81) Designated States (*national*): **AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, SY, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.**
- (84) Designated States (*regional*): **ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).**
- Published:
— *with international search report.*
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: **PRESERVATION OF DRIED VEGETABLE QUALITY IN PACKETED PETFOOD**

(57) Abstract: A method of preparing vegetable matter for inclusion in commercial packeted pet food, which includes the steps of: treating the vegetable material with sodium metabisulfite; dehydrating the vegetable matter, such that its relative water activity will be lower than about 0.40; coating the treated vegetable matter with humectant material; wherein said humectant material is selected from a group consisting of: a mixture of sorbitol, glucose and glycerol; a mixture of vegetable oil, glucose and glycerol; animal tallow.

WO 2004/017750 A1

PRESERVATION OF DRIED VEGETABLE QUALITY IN PACKETED PETFOOD

10/525357

BT01 Rec'd PCT/PTC 23 FEB 2005

FIELD OF THE INVENTION

The invention relates to the field of commercial pet food manufacture. In particular it relates to the treatment of vegetables that are intended to be components in a packeted pet food in order to prevent subsequent degradation of vegetable quality and appearance.

BACKGROUND OF THE INVENTION

A long-standing objective in the design of pet foods is to provide products that have components that are strongly reminiscent of human food. One particular objective is to include high-quality dehydrated vegetable material for its 'healthy' nutritional image and for its visual appeal, ie for the variety in shape and colour it adds to the product as a whole. Such vegetable material is typically blended with cereal- and meat-based products and packaged in relatively moisture-resistant bags for distribution and sale.

There are two particular challenges that are presented by including such materials in a packeted pet food. Firstly, the cereal- and meat-based kibbles, that tend to provide the bulk of such products, tend to have slightly higher moisture levels than the dehydrated vegetables. This leads, over time in intimate contact, to moisture migration from those kibbles into the vegetables. This in turn leads to discoloration of the vegetable materials via oxidation and other mechanisms, with resultant loss of visual appeal and saleability.

Secondly, pet mammals (typically felines and canines) tend not to find vegetable matter, especially when dehydrated, particularly intrinsically palatable. This may lead to the vegetable material being left behind in the pet's food bowl, which does not tend to be received favourably by the pet owner.

Therefore, there is a need to provide a treatment for vegetables, prior to inclusion in the pet food blend, that will both assist in preventing discoloration of the vegetables and will render them relatively more palatable to the animal.

Treatment of dried vegetable matter with a 'colour-fixing' agent such as sodium metabisulfite is known in the art to help preserve natural colour over time, especially where oxidation is the main cause of discoloration. However, simple treatment such as this will not be sufficient to overcome the added challenge of

preserving colour and texture where the dried vegetable matter is included in a packet with commercial pet food kibbles.

In such cases, it is thought to be beneficial to coat the vegetable pieces with a barrier material or humectant that will prevent the ingress of moisture, oxygen and other harmful compounds.

US Patent Document No. 4,832,969, by Lioutas, lists a number of such compounds that may be used particularly for dried vegetables for human consumption. This document strongly recommends the use of "low sweetness" sugars such as maltose, presumably as humans do not tend to like vegetables to taste sweet or 'sugary'. However, it is known that pet mammals do not always respond to the same flavour profiles as humans. In particular it may be suspected that one of the reasons that many pet mammals do not respond as well to the flavour profiles of vegetables as do humans, is due to this kind of divergence with human preferences. Therefore, treatments that work well in a human food context will not necessarily be suitable for pet mammal foods.

Therefore, it is an object of the present invention to provide vegetable material for inclusion in a packeted pet food product that is relatively resistant to the degradation to which such material is normally subjected in such packeted pet food products, and which is acceptably palatable to pet mammals.

SUMMARY OF THE INVENTION

According to one aspect of the invention, there is provided a method of preparing vegetable matter for inclusion in commercial packeted pet food, which includes the steps of:

treating the vegetable material with sodium metabisulfite;

dehydrating the vegetable matter, such that its relative water activity is less than about 0.40;

coating the treated vegetable matter with humectant material;

wherein said humectant material is selected from a group consisting of: a mixture of sorbitol, glucose and glycerol; a mixture of vegetable oil, glucose and glycerol; animal tallow.

In this document, where the term 'relative water activity' is used, it will be understood by those skilled in the art to refer to the proportion of water molecules present that are available to react, as compared to pure liquid water substance.

Preferably, the humectant is animal tallow, and is added at an amount sufficient to provide between 1% by mass and 10% by mass of the prepared vegetable material, even more preferably between 4% and 8% by mass. The animal tallow, while known to be palatable to pet mammals, has surprisingly been found to act very effectively in preventing discoloration and other deterioration of vegetable matter included in commercial packeted pet food products. Animal tallow has the added advantage of being the most cost effective of the suitable humectants, and is potentially easier to include in pet food formulations, as it is typically already available on-site at the pet food manufacturing facility. Use of animal tallow in this manner is not known in the prior art.

Beef and poultry tallow has been found to be particularly effective in this application.

Alternatively, where the selected humectant material is a mixture of sorbitol, glucose and glycerol, these ingredients are delivered as an aqueous solution of a mixture of all three ingredients combined in a mass ratio of approximately 1:1:1 and is added at an amount sufficient to provide the mixture of sorbitol, glucose and glycerol at between 1% and 10% by mass of the prepared vegetable material, and more preferably between 3% and 5% by mass. The selection of the known humectants sorbitol and glucose in this formulation is especially beneficial in this application, as they are both particularly 'sweet' tasting substances, and therefore make the vegetable material significantly more palatable to pet mammals than would be the case for either untreated vegetables or for vegetables treated with other known humectants, such as are recommended in prior art documents such as US 4,832,969, discussed above.

Alternatively, good results, with respect to both preservation of vegetable quality and palatability, may be obtained where the glycerol of the above formulation is replaced with vegetable oil, for example sunflower oil.

In a particularly preferred embodiment, the vegetable matter consists of size-reduced carrots and diced green beans, although many other types of vegetable matter, including peas, pumpkin, cabbage, tuber dehydrates and other vegetables are also suitable. Suitable size-reduction may include dicing.

In another aspect of the invention, there is provided vegetable material prepared in accordance with any of the embodiments of the method described above.

In another aspect of the invention, there is provided a commercial
5 packeted pet food, including vegetable material prepared in accordance with any of the embodiments of the method described above.

Now will be described, by way of a specific, non-limiting example, a preferred embodiment of the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

10 Diced carrots and diced green beans (in a relative proportion of 50:50 by mass) were prepared by a method according to the invention, as outlined below.

After dicing to approximate dimensions of 6mm x 6mm x 6mm and washing, the vegetables were blanched and then treated with sodium metabisulfite. This may alternatively be performed with or without processing
15 aides such as sodium carbonate or sodium citrate. The treated vegetables were hot air dried to achieve a water activity of below about 0.5, cooled to ambient temperature, inspected and packed.

Some of the vegetables were coated in beef tallow, of the kind typically available from livestock waste rendering plants. This was done by spraying the
20 tallow on to the vegetables at a mass rate of 4% and a temperature of about 60 – 70°C. Distribution of the tallow on the surface of the vegetables was achieved by tumbling the vegetables as the spray was applied.

Some of the vegetables were coated in a mixture of sorbitol, glucose and glycerol. The composition of the mixture was an aqueous solution of about 3%
25 sorbitol, 3% glucose and 3% glycerol by mass, and the final vegetable product included sorbitol, glucose and glycerol at a combined proportion of about 4%. Application of the mixture to the surfaces of the vegetables was done as per the beef tallow.

The remainder of the vegetable material was not coated with any
30 humectant material.

Each of the treated and untreated vegetable mixes were then individually blended into CESAR® DUO dog food, a premium pet food product marketed by the applicant, consisting of extruded cereal- and meat-based kibbles, and which

is typical of the type of packeted pet mammal food product known in the prior art. The addition rate of the vegetable material to the pet food kibbles was about 4% by mass. The blends underwent storage trials and palatability (feeding) tests.

During the storage trial, the treated vegetables were found to suffer no significant loss of quality when stored at 20°C, 37°C and 45°C for in excess of 8 weeks. However, the untreated vegetable matter showed the typical signs of deterioration associated with the prior art, primarily the development of brown colour and loss of crispness. Therefore, it is expected that the overall shelf life of the product may be increased to 2 years with treated vegetables, as opposed to only 3 months with untreated vegetables. Similar results were achieved with similar treatments using humectant mixtures consisting of sorbitol, glucose and glycerol, and with mixtures consisting of sunflower oil, glucose and glycerol.

In the feeding test, the following products were offered:

- Dry pet food kibble, as per CESAR® DUO, with untreated vegetable blend inclusion, as described above (Diet A);
- Dry pet food kibble, as per CESAR® DUO, with beef tallow treated vegetable blend inclusion, as described above (Diet B); and
- Dry pet food kibble, as per CESAR® DUO, with vegetable blend inclusion treated with glycerol/glucose/sorbitol, as described above (Diet C).

The diets were fed to a panel of dogs under controlled conditions. Briefly, the feeding protocol was as follows: a Relative Acceptance Test (RAT) was performed, based on a panel of small and toy dogs. Dogs were fed 150g per day.

Three measures were used to determine the relative palatability of the three diets:

- (a) Amount eaten (g): Mean of the amount of the product offered that was eaten in a single meal occasion;
- (b) % Ate All: The percentage of meals where all of the product that was offered was eaten; and
- (c) Enthusiasm: Mean score (on a scale of 1 to 100) of the owner's perception of the animal's enjoyment of the meal, where a higher score means the animal appeared to enjoy the meal more, and appeared to consume the meal more rapidly.

The results of the feeding test are given in Table 1. P-values given are based on a 95% confidence level.

Table 1.

Attribute	Diet A	Diet B	Diet C	p-value
Amount Eaten (g)	63b	71a	69a	0.013
Ate All (%)	10b	16a	12ab	0.062
Enthusiasm (scale 1-100)	55b	60a	60a	0.384

- 5 The results underwent statistical analysis via an ANOVA model with post hoc comparison. The results from the above table indicate that Diets B and C achieved significantly higher acceptance by the animal than that the diet including untreated carrots and beans.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of preparing vegetable matter for inclusion in commercial packeted pet food, which includes the steps of:

5 treating the vegetable material with sodium metabisulfite;

dehydrating the vegetable matter, such that its relative water activity is lower than about 0.40;

coating the treated vegetable matter with humectant material;

10 wherein said humectant material is selected from a group consisting of: a mixture of sorbitol, glucose and glycerol; a mixture of vegetable oil, glucose and glycerol; animal tallow.

2. The method of claim 1, wherein the humectant is animal tallow.

3. The method of claim 2, wherein said animal tallow is added to said vegetable matter at a rate sufficient to make up between 1% by mass and 10% by
15 mass of said coated vegetable material.

4. The method of claim 3, wherein said animal tallow is added to said vegetable matter at a rate sufficient to make up between 4% by mass and 8% by mass of said coated vegetable material.

5. The method of any preceding claim, wherein the animal tallow is derived
20 from beef and/or from poultry.

6. The method of claim 1, wherein said humectant material comprises a mixture of sorbitol, glucose and glycerol.

7. The method of claim 6, wherein the relative proportion of sorbitol, glucose and glycerol in said mixture is approximately 1:1:1.

8. The method of claim 7, wherein the mixture of sorbitol, glucose and glycerol is added to said vegetable matter at a rate sufficient to make up between
5 1% and 10% by mass of said coated vegetable material.

9. The method of claim 8, wherein the mixture of sorbitol, glucose and glycerol is added to said vegetable matter at a rate sufficient to make up between 3% and 5% by mass of said coated vegetable material.

10. The method of claim 1, wherein said humectant material comprises a
10 mixture of sorbitol, glucose and vegetable oil.

11. The method of claim 10, wherein the relative proportion of sorbitol, glucose and vegetable oil in said mixture is approximately 1:1:1.

12. The method of claim 11, wherein the mixture of sorbitol, glucose and vegetable oil is added to said vegetable matter at a rate sufficient to make up
15 between 1% and 10% by mass of said coated vegetable material.

13. The method of claim 12, wherein the mixture of sorbitol, glucose and vegetable oil is added to said vegetable matter at a rate sufficient to make up between 3% and 5% by mass of said coated vegetable material.

14. The method of any of claims 10 to 13, wherein said vegetable oil is
20 sunflower oil.

15. The method of any preceding claim, wherein said vegetable matter consists of one or more items selected from the group comprising carrots, green beans, peas, pumpkin, cabbage, and tubers.

16. The method of claim 15, wherein said vegetable matter is a blend of diced
25 carrots and diced green beans.

17. Vegetable matter, for inclusion in a commercial packeted pet food, prepared via a method according to any preceding claim.

18. A commercial packeted pet food, including vegetable matter prepared via a method according to any preceding claim.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU03/01071

A. CLASSIFICATION OF SUBJECT MATTERInt. Cl. ⁷: A23K 1/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

SEE ABOVE

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SEE BELOW

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIDS, CA, FSTA (FOOD, FEED, VEGETABLE, METABISULFITE, DEHYDRATED, HUMECTANT)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,109,026 A (Rahman <i>et al</i>), 22.08.1978. Abstract; Col 2, lines 29-51; example; claims.	1-18
Y	US 4,547,376 A (Silver <i>et al</i>), 15.10.1985. Abstract; col 2, lines 35-40; col 3 lines 57-60; col 4 lines 17-20, 55; example 1; claims.	1, 6-9, 15-18
Y	US 4,832,969 A (Lioutas), 23.05.1989. Abstract; col 1, lines 40-55; col 7, line 55 -col 8, line 40; examples; claims.	1, 6-9, 15-18

☒ Further documents are listed in the continuation of Box C☒ See patent family annex

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
19 September 2003

Date of mailing of the international search report

8 OCT 2003

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INTERNATIONAL SEARCH REPORT		International application No.
		PCT/AU03/01071
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	P. Kumar and V.V Sreenarayanan, Indian Food Packer, (2000), 54 (2): 73-75. Studies on storage of dehydrated onion flakes. Abstract, page 73 Materials and methods.	1, 6-9, 15-18
Y	Seshadri S., <i>et al</i> , International Journal of Food Sciences and Nutrition, (1997), 48 (6) : 373-379. Retention and storage stability of beta-carotene in dehydrated drumstick leaves (<i>Moringa oleifera</i>). Abstract, page 374 Materials and methods.	1, 6-9, 15-18
Y	Akpapunam, M. A. and Abiante, D. A., Plant Foods for Human Nutrition, (1991), 41 (4) : 291-297. Processing and quality evaluation of sweet potato chips. Abstract, page 293 lines 20-24, Results and Discussion.	1, 6-9, 15-18
Y	Pawar, V. D., <i>et al</i> , Indian Food Packer, (1985), 39 (4): 58-66. Studies on drying and rehydration of pumpkin (<i>Cucurbita maxima</i>). Abstract, page 60 Results and Discussion para 2.	1, 6-9, 15-18
Y	Baloch, A. K., <i>et al</i> , Pakistan Journal of Scientific and Industrial Research, (1981), 24 (5/6): 203-211. Effect of chemical treatments on the stability of dehydrated carrot. Abstract, materials and methods, page 205 col 2 lines 7-8 page 207 lines 5-6, conclusions.	1, 6-9, 15-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

AU03/01071

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
US	4109026	CA	1097981		
US	4547376	AU	36089/84	CA	1219765
		ES	8600888	JP	60133832
US	4832969	NONE		ES	538164
				US	4767630
END OF ANNEX					